C1850-2A
6/15/88

CAHNERS PUBLICATION

Electronic Business

FOR MANAGEMENT IN ELECTRONICS, COMPUTER & SYSTEMS COMPANIES — WORLDWIDE

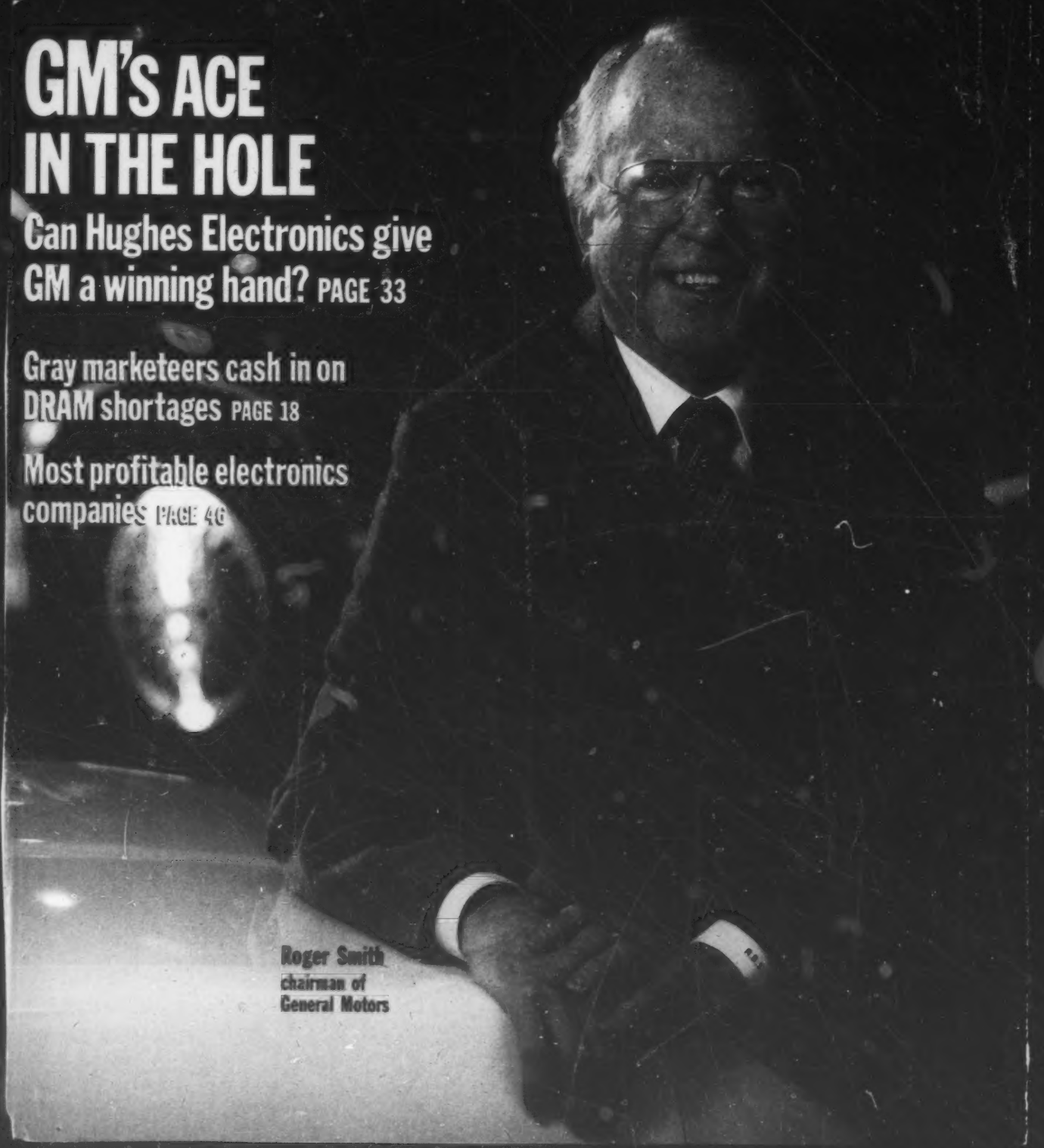
JUNE 1, 1988

GM'S ACE IN THE HOLE

Can Hughes Electronics give GM a winning hand? PAGE 33

Gray marketeers cash in on DRAM shortages PAGE 18

Most profitable electronics companies PAGE 46



Roger Smith
chairman of
General Motors

Electronic Business

FOR MANAGEMENT IN ELECTRONICS, COMPUTER AND SYSTEMS COMPANIES—WORLDWIDE

VOL. 14, NO. 11 JUNE 1, 1988

PAGE 34 GM chairman Roger Smith may have the last laugh

COVER STORY/STRATEGIES

AUTOMOTIVE ELECTRONICS

34 GM's ace in the hole

GM-bashers have had a field day in recent years as the auto giant has spent lavishly but ineffectually on acquisitions and plant automation. But one of Roger Smith's spending sprees—the $5 billion purchase of Hughes Aircraft—offers hope of straightening out GM's manufacturing mess. Hughes' expertise in systems engineering could give Smith the last laugh.

BUSINESS TRENDS

SEMICONDUCTORS

18 How the gray marketeers are cashing in on DRAM shortages

Desperately seeking DRAMs? Do as the small- and medium-sized systems firms are doing, and try gray market sources. But check those parts thoroughly.

TRADE

22 Da! Moscow summit peps up trade hopes

As U.S.-Soviet trade relations thaw, electronics firms like Honeywell are eagerly signing joint ventures.

TELECOMMUNICATIONS

26 Hot line to high growth for PBXs doing voice *and* data

Integrated switching exchanges are giving the PBX market its only strong growth. But usage is hardly widespread.

COVER STORY/STRATEGIES

AUTOMOTIVE ELECTRONICS

33 Automotive electronics: The race to build the car of the future

ELECTRONIC BUSINESS analyzes the critical competitive issues facing top management, both in Detroit and Tokyo.

34 Technology transfer at General Motors

GM chairman Roger Smith is just starting to reap the benefits of the Hughes acquisition—through CIM.

STRATEGIES

FINANCE

46 The proof is in the profits: 1987 wasn't half bad

With their new lean and mean look, top electronics companies posted profit gains last year. Software firms were winners; distributors weren't.

- The 100 most profitable electronics companies

ASIA BUSINESS

SEMICONDUCTOR PRODUCTION EQUIPMENT

59 Chip gear: Korea's appetite is not the U.S.'s delight

Korea's market for semiconductor materials and production equipment remains robust. Why are U.S. companies not ecstatic?

COMPUTER BUSINESS

NETWORK MANAGEMENT

70 Network management: Battle of the Network Stars

That's what it's like as AT&T, DEC, HP, IBM and Tandem, among others, vie for control of the corporate network and much, much more.

SMALL BUSINESS COMPUTERS

78 Double digit growth is back at Basic Four

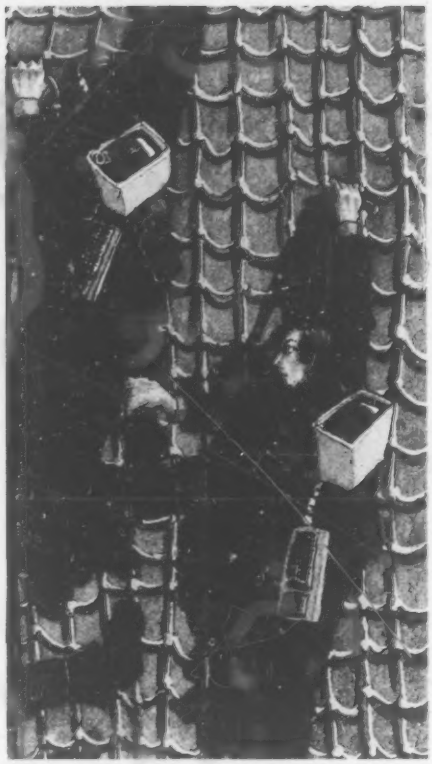
Basic Four has hit the fast track since it bought back its Canadian subsidiary and began targeting vertical markets.

Cover photo: Junebug Clark

PAGE 59 Korea's chip makers won't buy American

PAGE 46 Profits-wise, 1987 wasn't half bad

PAGE 18 Gray marketeers cash in on DRAM shortages



PAGE 70 Who's vying for control of the corporate network?

Market Perspectives

CAE

94 CAE software: Still bundled after all these years

Analysts insist that CAE companies must get out of hardware reselling. Some vendors and customers like bundling too much to agree. Here's why.

CAD/CAM

102 CAD/CAM after CV: Will anything really change?

As Prime Computer figures out how to manage its Computervision acquisition, rivals see opportunity. There could be strategic shifts for hardware suppliers, too.

Departments

5 **Inside Business**

9 **Upstarts**
Cirrus Logic, Ontologic, and Diamond Materials

11 **Executive Viewpoint**
Harris' Jon Cornell on why Sematech is the only choice U.S. chip makers have.

109 **Book Excerpts**
The new book *Competing for Control: America's Stake in Microelectronics* by Michael Borrus explains why vertical integration is no cure—and why the holding company concept could work.

116 **Coming Attractions**

119 **My View**
When the economic buyer says "NO."

120 **Management calendar**
Advertiser index

132 **Viewpoint**
Leadership in a leading indicator.

Business Barometer

FORECASTS AND INDEXES

127 **Semiconductors**
Back to basics for growth: RISC microprocessors.

128 **Industrial production**
Defense equipment and aircraft

130 **Leading indicator for the U.S. electronics industry**

Companies in this Issue

116 **An index of the 119 companies covered in this issue.**

EDITORIAL STAFF

Publisher: Frank J. Burge

Associate Publisher and Editorial Director: Alberto Socolovsky

Editor: Allen Furst

Managing Editor: John Kerr

Managing Editor/Special Projects: Norman Alster

Senior Editors: David Card, Alden M. Hayashi, Linda Stallmann, Anne Knowles

Associate Editors: Jack Gee, Beth Karlin, Bruce C. P. Rayner, Valerie Rice

Assistant Editor: Mary Donovan

Copy Editor: Barbara Jorgensen

Editorial Assistant: Sherri Hartlen

Contributing Editors: Stephen Gross (Minneapolis), Shohei Kurita (Tokyo), Michael Leibowitz (Boston), Philip Liu (Taiwan), Tom McCusker (Los Angeles), Lin Sun (Boston), Elizabeth Baatz (Cahners Economics), Madeline Franchi (Cahners Economics)

Managing Editor Production: Roger C. Plant

Production Editor: C.J. Korisky

Assistant Production Editor: Linda S. Cohen

ART STAFF

Art Director: Bill Cooke

Staff Artist: Christina Rutter

EDITORIAL OFFICES

Boston: Cahners Building
275 Washington Street, Newton, Mass. 02158 (617) 964-3030 Telex: 94 0573 CPC BSN 6502502256 MCI Fax: 617-964-5490

Washington, D.C.: Beth Karlin
1333 F Street NW, Suite 720
Washington, D.C. 20004 (202) 628-2773

San Jose, Calif.: Valerie Rice
Sherman Building, 3031 Tisch Way, Suite 100, San Jose, Calif. 95128 (408) 296-0868

Irvine, Calif.: Bruce C. P. Rayner
18818 Teller Avenue, Suite 170
Irvine, Calif. 92715 (714) 851-9422

Northwest: Paula Doe
5011 133rd Place SE
Bellevue, Wash. 98006 (206) 641-0903

Paris: Jack Gee
11, rue de Vaugirard, 75006, Paris, France
011-331-4-354-4200 Telex: 21 4235

PRODUCTION

VP Production: Wayne Hulitzky

Director of Production/Manufacturing: John R. Sanders

Production Supervisor: Bill Tomaselli

Production Manager: Betsy Harkins (617) 964-3030

CIRCULATION

Group Circulation Manager: Sherri Gronli

Circulation Manager: Eric Schmierer
271 St. Paul Street, Denver, Colo. 80206 (303) 388-4511

REPRINTS

ELECTRONIC BUSINESS articles are available on a custom printing basis at reasonable prices. Contact Joanne Westphal, Cahners Reprint Service, Cahners Plaza, 1350 E. Touhy Ave., PO. Box 5080, Des Plaines, Ill. 60018 (312) 635-8800
Total Circulation: 76,550

Don't ignore Detroit

Don't just think of the auto industry as a purchaser of electronics equipment. And don't just think of it as beginning and ending in Detroit, either. As Norm Alster, our managing editor for special projects, points out, the futures of the global auto and electronics industries are becoming increasingly intertwined. General Motors alone boasts electronics operations that generate revenue close to that of AT&T. And Japan's automotive giants are accelerating use of electronics in cars and applying ever higher tech procedures to their production.

To help electronics executives understand how to sell to, partner with and even compete with their automotive counterparts, Norm is assembling a four-part series that examines the electronics strategies of the auto empires: GM, Ford, Chrysler and Japan. We begin with a look at GM's infatuation with and successful application of electronics in manufacturing.

We think this series will become required reading not only for vendors of the parts and equipment that the auto industry buys in increasing quantities, but for anyone wanting to know how the GMs and Fords are redefining everything from technology-transfer techniques to quality standards for semiconductors.

Junebug Clark

GM chairman Roger B. Smith, at right, with Norm Alster

Electronics *glasnost*

Reagan and Gorbachev haven't limited their third summit to disarmament discussions; trade has been on the agenda, too. In April, Commerce Secretary William Verity took to Moscow a trade mission of 500 U.S. businessmen, all eager to ink pacts with the Soviets. In our "Business Trends" story, associate editor Beth Karlin looks at how detente between the superpowers bodes well for U.S. electronics firms, as well.

Got the blues? Get the grays

Desperate for DRAMs? Distributors have put you on allocation? Not to worry: the gray market will happily sell you unauthorized parts for outrageous prices. Contributing editor Michael Leibowitz tells how the gray marketeers are becoming the expensive answer to the prayers of many a parts-hungry systems company.

AL FURST

ELECTRONIC BUSINESS® (ISSN 0163-6197) is published semi-monthly, except monthly in December, by The Cahners Publishing Company, A Division of Reed Publishing USA, 275 Washington Street, Newton, MA 02158-1630. Terrence M. McDermott, President; Frank Sibley, Group Vice President; Jerry D. Neth, Vice President/Publishing Operations; J.J. Walsh, Financial Vice President/Magazine Division; Thomas J. Dellamaria, Vice President/Production and Manufacturing. Circulation records are maintained at Cahners Publishing Company, 44 Cook Street, Denver, CO 80206-5191. Telephone: (303)388-4511. Second-class postage paid at Denver, CO 80206-5191 and additional mailing offices. POSTMASTER: Send address corrections to ELECTRONIC BUSINESS® at the Denver address. ELECTRONIC BUSINESS® copyright 1988 by Reed Publishing USA; Saul Goldweitz, Chairman; Ronald G. Segel, President/C.E.O.; Robert L. Krakoff, Executive Vice President; William M. Platt, Senior Vice President. Annual subscription rates for non-qualified people: USA/Canada/Mexico, $55 per year; other countries, $85 per year (including air freight); $170 per year for air mail. Except for special issues where price changes are indicated, single copies of regular issues are available for $6.00, $8.00 and $10.00 (USA, Canada/Mexico and foreign). Please address all subscription mail to Eric Schmierer, 44 Cook Street, Denver, CO 80206-5191. Cahners Publishing Company, A Division of Reed Publishing USA • Specialized Business Magazines for Building & Construction • Manufacturing • Foodservice & Lodging • Electronics & Computers • Interior Design • Printing • Publishing • Industrial Research & Technology • Health Care • Entertainment. Specialized Consumer Magazines: American Baby • Modern Bride.

VBPA ABP

Hot line to high growth for PBXs doing voice *and* data

Integrated switching exchanges are giving the PBX market its only strong growth. But usage is hardly widespread

Today's users of private branch exchanges don't just want equipment that handles voice communications. Nor are they satisfied only with PBXs dedicated to computer data. What they'd prefer are exchanges that deal with voice and data simultaneously.

That preference is one that PBX makers like Rolm, AT&T, and Northern Telecom Inc. are responding to. According to Boston-based consultancy the Yankee Group, U.S. shipments of data lines in integrated PBXs grew by about 40% last year, as did revenue: from $234 million in 1986 to $304 million in 1987 and climbing to $548 million by 1990. That is in striking contrast to the performance of the PBX market as a whole, which increased by only 5% in the same period.

The push toward integrated PBXs has competitive implications for vendors of other communications links such as LANs. And it will play a significant role in development of the integrated services digital network (ISDN) technology that combines voice and data on the same phone line, and which is of considerable interest to telecom equipment makers across the United States.

However, voice/data PBXs have not yet made much of a mark. The Yankee Group notes that data line PBX shipments are currently 6% to 7% of total PBX shipments, and that the installed base of data lines is a mere 3% of the total PBX lines installed in 1987. The reason, simply put: applications are driving the market, rather than the technology.

Hesitations

Three main factors contribute to development of the voice/data PBX market: applications requirements, price-performance and the impact of other existing technologies. The major applications concerns are in operating standards and in compatibility with existing telecom systems. To overcome customers' hesitations in investing in this new technology, the current products are touted as having standard interfaces and even as being "ISDN ready." AT&T, with its series 75 and 85 digital PBXs, claims it meets the primary rate interface (PRI), an interface standard conforming to the CCITT's ISDN specifications and which AT&T says enables different devices to be connected to the host. Northern Telecom also focuses on ISDN architecture standards.

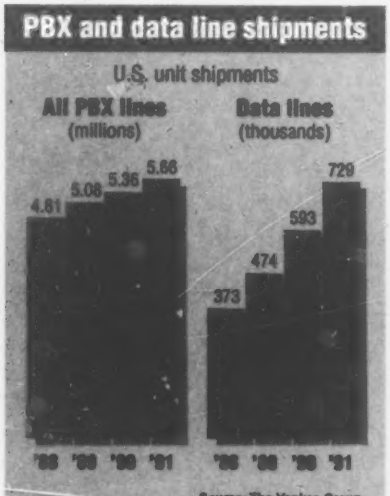
Cost payoff is another crucial factor, especially for those currently using LANs. According to the Yankee Group, adding a data line could cost from $450 up to $1,200, while having data PBXs (non-voice switching) costs only $150 per port.

And PBXs need to pick up the pace. LAN networking speeds of 10 megabits per second (Mbps) are common today, while packet switching can only reach 2Mbps and 64Kbps in non-packet switching networks. As David Yedwad, a researcher at PBX market analysis firm The Eastern Management Group, comments, voice/data PBXs provide "little solution powerful enough to make people change their minds."

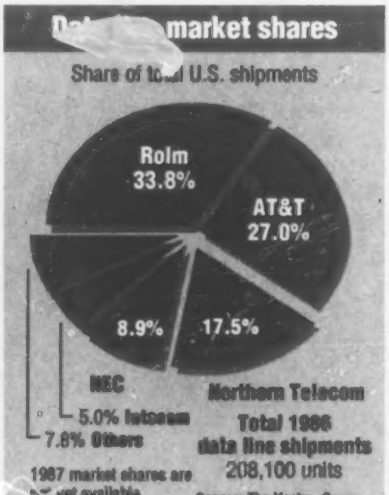
However, major makers of integrated PBXs hold a different view. Jay Misra, program manager for the 9751 systems at IBM offshoot Rolm, which together with AT&T and Northern Telecom holds 78% of the integrated PBX market, does not consider the low-speed transmission on PBXs a drawback; instead, he looks at it as a market niche that the new PBXs should fill. To him, voice/data PBXs are not competing with other networking technologies, because "market applications require a range of networking alternatives." All of the PBXs shipped by market leader Rolm have 20% of their lines committed to data switching.

The market for voice/data PBXs is expected to grow by 20% to 25% annually through the early 1990s, and costs will fall: the Yankee Group predicts that the price per data line will drop by an average of 3% each year, due largely to improved IC functionality. In general, the price will drop from about $1,000 in 1987 down to $900 in 1991. By coexisting rather than competing with other network technologies, voice/data PBX applications are expected to exceed those for data-only PBXs, ranking in third place behind direct wiring and LANs.

LIN SUN



Compared with the total PBX market, sales of data lines are taking off



Rolm and AT&T own the largest slices of the fast-growing data-line segment

The proof is in the profits: 1987 wasn't half bad

With their new lean and mean look, top electronics companies posted profit gains last year. Software firms were winners; distributors weren't

BY BRUCE C.P. RAYNER and LINDA STALLMANN

Despite the October stock market crash, 1987 was a good year for the bottom line in electronics. Export sales grew as a result of the cheaper dollar, a lower corporate tax rate took effect and the painful corporate paring-down purge started to pay off. As a result, electronics companies are now leaner, meaner and more competitive than they were a year ago.

The ELECTRONIC BUSINESS 100 most profitable electronics companies posted a weighted average after-tax profit rate of 7.8% in 1987, up from 6.7% in 1986. But whether or not profits will continue their upward climb in 1988 will depend on each industry segment's overall market strength and the strength of the economy, experts say.

Looking out to 1991, Stanley Feldman, an economist and senior vice president with research firm Data Resources Inc., expects electronics to post above average cash flow — an estimate of net income — of around 8.5% to 9%. Cash flow for electronic components will grow at a 10% rate between 1987 and 1991, Feldman forecasts, while communications equipment will grow at a 9.5% rate and computers at a slower 7.5% rate.

But for stellar performers, industry averages have little to do with individual performance. For the second year in a row, the high flier on the ELECTRONIC BUSINESS list of most profitable companies is Minneapolis-based Cray Research Inc., maker of multimillion dollar supercomputers. Cray posted a 21.4% profit margin in 1987, up from its 20.9% performance in 1986. William Easterbrook, an industry analyst with investment brokerage Kidder Peabody & Co., expects Cray to top the list again next year, but believes the halcyon days for the mega-mainframe maker are drawing to a close. "I expect their profitability over this year and the next few years will decline because of product transition and increasing competition from the low end," he says.

Overall, the computer segment of electronics improved its profitability in 1987 to 9.4%, up from 8.1% in 1986. As a whole, the 21 computer makers account for 58% of total revenue of the top 100 companies on the list. Part of the improvement in profits for computer vendors is the result of restructuring, industry experts say. For instance, analyst Easterbrook expects IBM's 1988 profit rate to improve from a 9.7% rate in 1987 to 10% this year, partly as a result of its early retirement program.

Marty Braun

The award for the outstanding industry segment goes to a first-time entrant on the ELECTRONIC BUSINESS most profitable list: software. Although it accounts for less than 1% of total revenue of the 100 companies, software puts all other electronics segments to shame with an average profitability rate of 16.5% for 1987. Of the top five most profitable companies, three are software companies: Microsoft Corp.; Lotus Development Corp.; and Ashton-Tate Corp., in that order.

The only segment on the list to post a decline in profitability for 1987 was office equipment, dropping from a 7.8% profit rate in 1986 to 5.3%. The reason is that Xerox Corp., the largest office equipment vendor on the list, posted a profit rate of only 3.9%, and IBM, which was classified as an office equipment maker last year, was reclassified as a computer company this year.

Similarly, electronics distribution completely missed the boat this year. With five entrants for 1986, the distributors were still suffering from tough times. Sagging margins and overstocked shelves resulted in poor profit performance. Typically, distribution is often the last industry segment to benefit from a recovery.

On the other hand, the defense industry, renowned for its cries of declining profits, came through in 1987 with a respectable showing. In all, eight defense contractors made the top 100 list, posting an average 4.6% profit rate in 1987, up from a meager 2.9% in 1986.

To qualify for the top 100 most profitable list, companies must be publicly held and have at least 70% of their sales in electronics. Also, total fiscal year 1987 sales must top $80 million. Profits are calculated after taxes but before any extraordinary items, to reflect as best as possible earnings from operations. No adjustment is made for differences in fiscal years. □

1987's most profitable companies

1987 rank	Company	Net profit as a percentage of revenue	Fiscal 1987 sales ($ millions)	Fiscal 1987 profits ($ millions)	Fiscal year ended	Location
1	Cray Research	21.4%	$687.3	$147.1	12/87	Minneapolis, Minn.
2	Microsoft	20.8%	345.9	71.9	6/87	Redmond, Wash.
3	Lotus Development	18.2%	395.6	72.0	12/87	Cambridge, Mass.
4	Ashton-Tate	16.1%	267.3	43.1	1/88	Torrance, Calif.
5	Cincinnati Microwave	15.2%	80.9	12.3	12/87	Cincinnati, Ohio
6	Digital Communications	14.9%	181.4	27.0	6/87	Alpharetta, Ga.
7	Medtronic	14.7%	502.0	73.8	4/87	Minneapolis, Minn.
8	Seagate Technology	14.6%	958.1	139.7	6/87	Scotts Valley, Calif.
9	Sensormatic Electronics	14.0%	98.3	13.8	5/87	Deerfield Beach, Fla.
10	Intel	13.0%	1,907.1	248.1	12/87	Santa Clara, Calif.
11	Maxtor	12.8%	175.3	22.4	3/87	San Jose, Calif.
12	DEC	12.1%	9,389.4	1,137.4	6/87	Maynard, Mass.
13	Oracle	11.9%	131.3	15.6	3/87	Belmont, Calif.
14	Measurex	11.8%	227.4	26.8	11/87	Cupertino, Calif.
15	Atari	11.6%	493.2	57.4	12/87	Sunnyvale, Calif.
16	Molex	11.2%	386.8	43.4	6/87	Lisle, Ill.
17	Compaq	11.1%	1,224.1	136.3	12/87	Houston, Texas
18	Evans & Sutherland	11.0%	134.4	14.7	12/87	Salt Lake City, Utah
19	Intergraph	10.9%	641.1	69.9	12/87	Huntsville, Ala.
20	AMP	10.8%	2,318.0	250.0	12/87	Harrisburg, Pa.
21	Stratus Computer	10.5%	184.2	19.4	12/87	Marlboro, Mass.
22	Tandem Computers	10.2%	1,035.5	105.6	9/87	Cupertino, Calif.
23	3Com	10.1%	110.4	11.1	5/87	Santa Clara, Calif.
24	Aydin	9.9%	149.2	14.8	12/87	Horsham, Pa.
25	IBM	9.7%	54,217.0	5,258.0	12/87	Armonk, N.Y.
26	Micropolis	9.4%	288.3	27.2	12/87	Chatsworth, Calif.
27	Amdahl	9.4%	1,505.2	142.0	12/87	Sunnyvale, Calif.
28	Gerber Scientific	9.4%	223.9	21.1	4/87	South Windsor, Conn.
29	Analogic	9.3%	155.4	14.5	7/87	Peabody, Mass.
30	Telex	9.3%	840.7	77.9	3/87	Tulsa, Okla.
31	Western Digital	9.3%	462.5	42.8	6/87	Irvine, Calif.
32	Mentor Graphics	9.2%	221.8	20.3	12/87	Beaverton, Ore.
33	ADC Telecommunications	9.1%	166.9	15.3	10/87	Bloomington, Ind.
34	Pitney Bowes	8.9%	2,250.5	199.4	12/87	Stamford, Conn.
35	MiniScribe	8.6%	362.5	31.1	12/87	Longmont, Colo.
36	Loral	8.3%	690.0	57.5	3/87	New York, N.Y.
37	Plantronics	8.2%	111.5	9.1	5/87	San Jose, Calif.
38	Apple Computer	8.2%	2,661.1	217.5	9/87	Cupertino, Calif.
39	Diebold	8.1%	439.1	35.8	12/87	Canton, Ohio
40	Ask Computer	8.1%	98.3	8.0	6/87	Los Altos, Calif.
41	Ultimate	8.0%	172.9	13.8	4/87	East Hanover, N.J.
42	Hewlett-Packard	8.0%	8,090.0	644.0	10/87	Palo Alto, Calif.
43	Dynatech	7.6%	304.7	23.2	3/87	Burlington, Mass.
44	NCR	7.4%	5640.7	419.3	12/87	Dayton, Ohio
45	Quantum	7.3%	120.8	8.8	3/87	Milpitas, Calif.
46	QMS	7.3%	119.4	8.7	9/87	Mobile, Ala.
47	MAI Basic Four	7.1%	321.0	22.8	9/87	Tustin, Calif.
48	Tandy	7.0%	3,452.2	242.3	6/87	Fort Worth, Texas
49	Wyse Technology	7.0%	260.0	18.1	3/87	San Jose, Calif.
50	Archive	6.9%	88.8	6.1	9/87	Costa Mesa, Calif.

Net profits are from continuing operations after taxes and before extraordinary items

Source: ELECTRONIC BUSINESS

(Continued)

1987's most profitable companies

1987 rank	Company	Net profit as a percentage of revenue	Fiscal 1987 sales ($ millions)	Fiscal 1987 profits ($ millions)	Fiscal year ended	Location
51	Sun Microsystems	6.8%	$537.5	$36.3	6/87	Mountain View, Calif.
52	Prime Computer	6.7%	960.9	64.8	12/87	Natick, Mass.
53	Watkins-Johnson	6.7%	264.3	17.8	12/87	Palo Alto, Calif.
54	Applied Magnetics	6.7%	211.9	14.2	9/87	Goleta, Calif.
55	Computer Consoles	6.5%	148.4	9.6	12/87	Waltham, Mass.
56	AST Research	6.3%	206.0	13.0	6/87	Irvine, Calif.
57	Altos Computer	6.3%	153.9	9.7	6/87	San Jose, Calif.
58	MTS Systems	6.3%	113.1	7.1	9/87	Minneapolis, Minn.
59	Intelligent Systems	6.2%	163.2	10.2	12/87	Norcross, Ga.
60	Micom Systems	6.2%	196.7	12.2	3/87	Simi Valley, Calif.
61	Unisys	6.0%	9,712.9	578.0	12/87	Detroit, Mich.
62	Tandon	5.9%	289.1	17.1	12/87	Chatsworth, Calif.
63	AVX	5.8%	271.9	15.8	12/87	Great Neck, N.Y.
64	Computer & Communications	5.7%	98.8	5.7	12/87	San Diego, Calif.
65	Diasonics	5.7%	267.6	15.2	12/87	South San Francisco, Calif.
66	Eldec	5.6%	99.4	5.5	3/87	Lynnwood, Wash.
67	Triad Systems	5.5%	117.3	6.4	9/87	Livermore, Calif.
68	Qantel	5.4%	88.0	4.8	4/87	Parsippany, N.J.
69	Avantek	5.4%	213.7	11.6	12/87	Santa Clara, Calif.
70	Electrospace Systems	5.3%	190.7	10.1	3/87	Richardson, Texas
71	Analog Devices	5.0%	370.4	18.7	10/87	Norwood, Mass.
72	GM Hughes Electronics	5.0%	10,481.0	521.1	12/87	Detroit, Mich.
73	E-Systems	4.9%	1,227.2	60.4	12/87	Dallas, Texas
74	Regency Electronics	4.9%	495.3	24.3	6/87	Indianapolis, Ind.
75	Scientific-Atlanta	4.9%	495.3	24.3	6/87	Atlanta, Ga.
76	Lee Data	4.7%	114.5	5.4	3/87	Minneapolis, Minn.
77	Veeco Instruments	4.7%	195.6	9.2	9/87	Melville, N.Y.
78	VLSI Technology	4.7%	172.0	8.1	12/87	San Jose, Calif.
79	DSC Communications	4.7%	312.4	14.6	12/87	Plano, Texas
80	Motorola	4.6%	6,700.0	308.0	12/87	Schaumburg, Ill.
81	Texas Instruments	4.6%	5,594.5	256.9	12/87	Dallas, Texas
82	Nicolet Instruments	4.5%	121.6	5.4	3/87	Madison, Wis.
83	Recognition Equipment	4.2%	264.7	11.2	10/87	Dallas, Texas
84	LSI Logic	4.1%	262.1	10.7	12/87	Milpitas, Calif.
85	Systems Industries	4.1%	119.5	4.9	7/87	Milpitas, Calif.
86	Harris	4.1%	2,079.0	84.5	6/87	Melbourne, Fla.
87	CTS	4.0%	261.1	10.5	12/87	Elkhart, Ind.
88	Apollo Computer	3.9%	553.7	21.7	12/87	Chelmsford, Mass.
89	Xerox	3.9%	14,900.0	578.0	12/87	Stamford, Conn.
90	ISC Systems	3.9%	168.5	6.5	6/87	Spokane, Wash.
91	Honeywell	3.8%	6,679.3	253.7	12/87	Minneapolis, Minn.
92	Varo	3.7%	95.3	3.5	4/87	Garland, Texas
93	Augat	3.7%	313.2	11.5	12/87	Mansfield, Mass.
94	Tektronix	3.7%	1,395.9	51.2	5/87	Beaverton, Ore.
95	Wavetek	3.7%	82.5	3.0	9/87	San Diego, Calif.
96	Mark IV Industries	3.5%	291.5	10.2	2/87	West Amherst, N.Y.
97	Genicom	3.5%	302.2	10.5	12/87	Waynesboro, Va.
98	Silicon Systems	3.5%	81.8	2.8	9/87	Tustin, Calif.
99	Dynascan	3.4%	191.6	6.6	12/87	Chicago, Ill.
100	Emulex	3.4%	103.8	3.5	6/87	Costa Mesa, Calif.

Net profits are from continuing operations after taxes and before extraordinary items

Source: ELECTRONIC BUSINESS

(Continued)

1987's most profitable companies by industry segment

Software

	Net profit as a percentage of revenue	1987 rank
Microsoft	20.8%	2
Lotus Development	18.2%	3
Ashton-Tate	16.1%	4
Oracle	11.9%	13
Ultimate	8.0%	41
Weighted average	**16.5%**	

Computers

	Net profit as a percentage of revenue	1987 rank
Cray Research	21.4%	1
Digital Equipment	12.1%	12
Atari	11.6%	15
Compaq Computer	11.1%	17
Stratus Computer	10.5%	21
Tandem Computers	10.2%	22
3Com	10.1%	23
IBM	9.7%	25
Amdahl	9.4%	27
Analogic	9.3%	29
Telex	9.3%	30
Apple Computer	8.2%	38
MAI Basic Four	7.1%	47
Tandy	7.0%	48
Sun Microsystems	6.8%	51
Prime Computer	6.7%	52
Altos	6.3%	57
Unisys	6.0%	61
Computer & Communications	5.7%	64
Qantel	5.4%	68
Apollo Computer	3.9%	88
Weighted average	**9.4%**	

Components

	Net profit as a percentage of revenue	1987 rank
Molex	11.2%	16
AMP	10.8%	20
AVX	5.8%	63
Eldec	5.6%	66
Veeco Instruments	4.7%	77
CTS	4.0%	87
Augat	3.7%	93
Weighted average	**9.0%**	

Peripherals

	Net profit as a percentage of revenue	1987 rank
Seagate Technology	14.6%	8
Maxtor	12.8%	11
Micropolis	9.4%	26
MiniScribe	8.6%	35
Quantum	7.3%	45
QMS	7.3%	46
Wyse Technology	7.0%	49
Archive	6.9%	50
Applied Magnetics	6.7%	54
Intelligent Systems	6.2%	59
Tandon	5.9%	62
Lee Data	4.7%	76
Systems Industries	4.1%	85
Genicom	3.5%	97
Emulex	3.4%	100
Weighted average	**8.9%**	

Computer-based systems

	Net profit as a percentage of revenue	1987 rank
Measurex	11.8%	14
Evans & Sutherland	11.0%	18
Intergraph	10.9%	19
Mentor Graphics	9.2%	32
Ask Computer Systems	8.1%	40
Computer Consoles	6.5%	55
Triad Systems	5.5%	67
Recognition Equipment	4.2%	83
ISC Systems	3.9%	90
Mark IV Industries	3.5%	96
Weighted average	**7.9%**	

Capital equipment

	Net profit as a percentage of revenue	1987 rank
Gerber Scientific	9.4%	28
Hewlett-Packard	8.0%	42
MTS Systems	6.3%	58
Nicolet Instruments	4.5%	82
Tektronix	3.7%	94
Wavetek	3.7%	95
Weighted average	**7.3%**	

Semiconductors

	Net profit as a percentage of revenue	1987 rank
Intel	13.0%	10
Western Digital	9.3%	31
Analog Devices	5.0%	71
VLSI Technology	4.7%	78
Texas Instruments	4.6%	81
LSI Logic	4.1%	84
Silicon Systems	3.5%	98
Weighted average	**6.6%**	

Office equipment

	Net profit as a percentage of revenue	1987 rank
Pitney Bowes	8.9%	34
Diebold	8.1%	39
NCR	7.4%	44
Xerox	3.9%	89
Weighted average	**5.3%**	

Communications

	Net profit as a percentage of revenue	1987 rank
Cincinnati Microwave	15.2%	5
Digital Communications	14.9%	6
Aydin	9.9%	24
ADC Telecommunications	9.1%	33
Dynatech	7.6%	43
Micom Systems	6.2%	60
Avantek	5.4%	69
Scientific-Atlanta	4.9%	75
Regency Electronics	4.9%	74
DSC Communications	4.7%	79
Motorola	4.6%	80
Dynascan	3.4%	99
Weighted average	**5.2%**	

Government

	Net profit as a percentage of revenue	1987 rank
Loral	8.3%	36
Watkins-Johnson	6.7%	53
Electrospace Systems	5.3%	70
GM Hughes Electronics	5.0%	72
E-Systems	4.9%	73
Harris	4.1%	86
Honeywell	3.8%	91
Varo	3.7%	92
Weighted average	**4.6%**	

Net profits are from continuing operations after taxes and before extraordinary items.
Source: Electronic Business

Chip gear: Korea's appetite is not the U.S.'s delight

Korea's market for semiconductor materials and production equipment remains robust. Why are U.S. companies not ecstatic?

BY OLES GADACZ

South Korea's electronics industry is booming. In particular, Korea is looking to export $885 million worth of chips this year — double last year's $439 million. Accordingly, the country's semiconductor makers are planning to expand their plants, providing ample opportunity for suppliers of materials and manufacturing machinery. Indeed, the top four Korean chip companies will spend more than $450 million on capital equipment this year. Because Korea has no semiconductor infrastructure to speak of, the country will have to depend on foreign vendors.

But U.S. suppliers of semiconductor materials and production equipment are hardly ecstatic. Korea's imports of U.S. electronic goods were less than half the $2.7 billion bought from Japan in 1986. In the same year, North America ran up a $2.6 billion deficit in its trade of electronic goods with Korea. In contrast, Japan managed a $2.1 billion surplus.

Pricing appears to be the No. 1 culprit. "If we have a price war, we can't beat the Japanese. They'll cut prices 50%. No U.S. company can do that," sighs S.K. Suh, president of Varian Korea Ltd., the Korean subsidiary of Varian Associates Inc., headquartered in Palo Alto, Calif.

Even with the yen value soaring vis-à-vis the dollar's plummet, Japanese companies have continued their aggressive pricing practices. "The Japanese . . . seem to be getting more market share even though their yen is going up. They're as powerful as ever," observes Lim In Sang, branch manager for Perkin-Elmer Korea Corp.

The Japanese maintain that their price slashing reflects their lofty philosophy of pursuing market share at the expense of short-term profits. Others, however, contend that the Japanese way of doing business is anything but admirable. "Once they hook a customer on their system and support, it's difficult [for the customer] to choose another vendor," asserts Lim. Adds customer Yang Jae Kyu, an engineer with Daewoo Telecom Company Ltd., "For the Japanese, the initial quoted price is just a starting point. It doesn't mean anything. . . . They make up for their low prices with high-priced spare parts [later on]."

Goldstar, historically a customer of U.S. machinery, will probably be buying more Japanese gear in the future, says Song Dae Ho, a Goldstar director

Punching in and out

Customer support is another reason why Koreans prefer to deal with the Japanese, in spite of deep-seated animosities between the two peoples. Koreans detect the Japanese willingness to please the customer at any cost. Song Dae Ho, a director in charge of semiconductor manufacturing at Goldstar Semiconductor Company Ltd., faults U.S. service personnel for their "punch in and punch out" approach to work. In contrast, Song notes that the Japanese will work overnight, if necessary, to assist customers. "If we have problems, they answer immediately and fly in the next day. That's the difference," says Song.

Consequently, Song says that Goldstar is leaning toward buying more from the Japanese even though

the company has traditionally bought American. "In our case, 70% of our equipment comes from the U.S.," he says. "[But] recently we've introduced Japanese equipment and I think Japanese equipment will occupy a higher percentage in the future."

The United States' loss of Goldstar's business could be considerable. The company will spend $100 million this year for capital equipment procurement alone. And Goldstar has no plans of slowing down; it has announced an annual budget of $100 million for the next five years. In particular, the company surprised the semiconductor industry with its announcement last December that it was planning to mass produce 1-megabit DRAM chips at its Gumi facility this year.

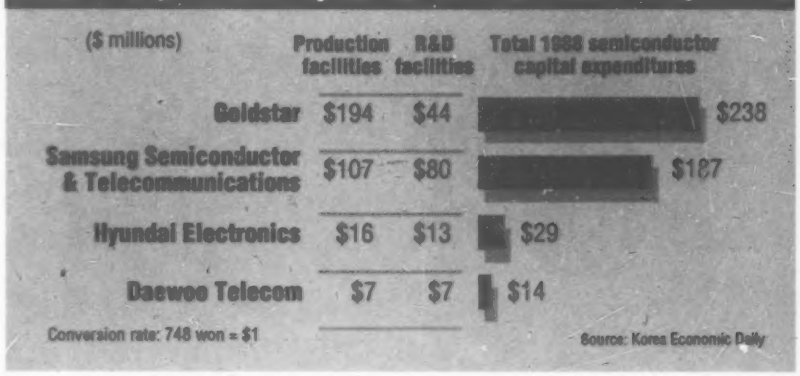
Goldstar's heavy spending has not gone by unnoticed. "We're worried that they're starting to lean more toward the Japanese," says Suh of Varian, which claims 75% of the Korean sputtering systems market and an 85% share of the country's ion implanters market.

Sometimes the problem is that the U.S. equipment has failed to live up to expectations. Rumor has it that Hyundai Electronics Industries Company Ltd. has had problems with the yields of its 256-kilobit DRAMs because of U.S. steppers. Consequently, the company is reportedly looking to buy the same equipment from a Japanese supplier. Hyundai officials would not comment.

Still, perhaps because of political pressures brought on by United States-Korea trade friction, some Korean companies seem determined to buy American. In Kiheung, an hour's drive outside of Seoul, Samsung Semiconductor & Telecommunications Company Ltd. is in the process of adding a new line for 1Mb and 4Mb DRAM chips. For the expansion, Kim Hyeon Gon, Samsung's managing director for strategic planning, promises, "Most of the equipment will be purchased from the U.S."

One area in which U.S. companies could excel is the market for machinery specifically tailored for producing semiconductors made of gallium arsenide (GaAs). This tiny market niche could reach significant proportions as many Korean chip makers begin dabbling with the new material.

Capital expenditures by Korean semiconductor companies



Goldstar Cable Co. is putting the finishing touches on its 3-inch wafer GaAs line. Last year, the company reinforced its development facilities with new, imported crystal-growing equipment.

Newcomers Kukje Corp., a subsidiary of Hanil, and Sammi have invested a combined total of more than $7 million to enter the GaAs market. Hanil, a leading maker of synthetic textiles in Korea, will commence with the production of GaAs light-emitting and laser diodes.

Furthermore, Korea's government is coordinating a project to develop a 4K SRAM GaAs chip by 1991. In addition, the government-run Electronics and Telecommunications Research Institute is heading up a research consortium to develop a 4Mb DRAM. The private sector participants include Goldstar, Hyundai and Samsung, which are collectively spending $64 million on research equipment.

> **"If we have a price war, we can't beat the Japanese"**
> **S.K. Suh, Varian**

One area of technology that has seen slow acceptance in Korea is that of surface mount. Indeed, a Korean trading agent estimates that the country imported only $10 million of surface mount equipment last year.

Executives at Samsung and Goldstar agree that their companies are still at least a year or two away from making a major push in surface mount technology. "We'll eventually look at SMT but I can't say when it'll happen," says Kim Jong Soon, a director in the semiconductor research division of Goldstar. Still, Daewoo Telecom says it will soon be making its personal computers — which are sold in the United States through Leading Edge Hardware Products Inc. of Canton, Mass. — using surface mount technology.

West Germany's push

The United States and Japan are not the only countries vying for a chunk of Korea's semiconductor infrastructure. West Germany's Hoechst has a stake in a $20 million photoresist and processing chemical plant in Korea that is due to start up this year.

And a few Korean companies — formerly based on now-waning industries like footwear, textiles and cement — are eagerly diversifying into the semiconductor materials and equipment market. Jeil Synthetic Textile Co., a Samsung Group subsidiary, recently invested $15 million to introduce photoresist manufacturing in Korea.

To counter the growing competition, some U.S. companies are attempting to strengthen their Korean beachhead by commencing manufacturing in the country. Last year, Macro LSI and E.I. du Pont de Nemours & Co. each entered into a separate joint venture to produce photomasks in Korea. Both companies' local partners had virtually no experience in electronics. □

[Editor's note: Dollar figures cited in this article were calculated at a conversion rate of $1 = 748 won]

Network management: Battle of the Network Stars

That's what it's like as AT&T, DEC, HP, IBM and Tandem, among others, vie for control of the corporate network and much, much more

BY PHILIP J. GILL

It might be called "Battle of the Network Stars," to steal a beat from a popular television game show. And a game it is, but not for the amusement of bleary-eyed contestants and television viewers. The network management game is being played for the benefit of the world's largest corporations, as well as for numerous medium- and small-sized firms. The prize: control of corporate computer and telecommunications networks.

On the surface, that might seem paltry, given the many billions of dollars in sales of computer systems sold every year by the leading contenders in network management. In comparison, *Fortune* 1,000 firms spent less than 1% of their total communications budgets on network management products and services, or about $500 million out of total expenditures of $51 billion in 1987, estimates Forrester Research Inc., a Cambridge, Mass., consulting firm.

But in the long run, network management will have a far-reaching impact not just on users and suppliers, but also on computer and communications equipment makers and the semiconductor and component manufacturers which supply them. The real prize is not so much sales of network management products and services — at least not until the market grows larger — but rather, sales of the systems and peripherals they will monitor. Indeed, during the last two to three years, network management has emerged as one of the key strategic battlegrounds for the industry's major computer and communications systems manufacturers.

"The strategic importance of network management is that if you do not have a very good or even superior network management offering, you're not going to be able to sell your computer systems," says Bernard Gudion, marketing manager for networking at Hewlett-Packard Co.'s Cupertino, California-based Information Networks Division. If they don't play the network management game, Gudion contends, vendors face a possible lock-out on lucrative commercial and government computer procurements.

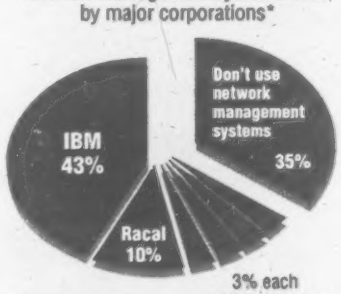
"It hasn't gotten to that point [yet]," counters David Korf, manager for network management marketing at Digital Equipment Corp. in Merrimack, N.H. "But it's certainly headed in that direction."

And then there's the fact that many a large market started out small. Early market leadership could well entrench key players, locking out opposition as the market grows in size and importance.

Increasing reliance on computers and networking within businesses will dramatically drive up the cost of network management goods and services between now and 1991, according to Forrester. In that year, network management expenditures will reach $2.8 billion, almost six times that of today's figures, although less than 4% of the total amount spent on communications.

Contenders in the network management systems market

Network management systems used by major corporations*



* Based on a survey of *Fortune* 1,000 companies

Source: Forrester Research Inc.

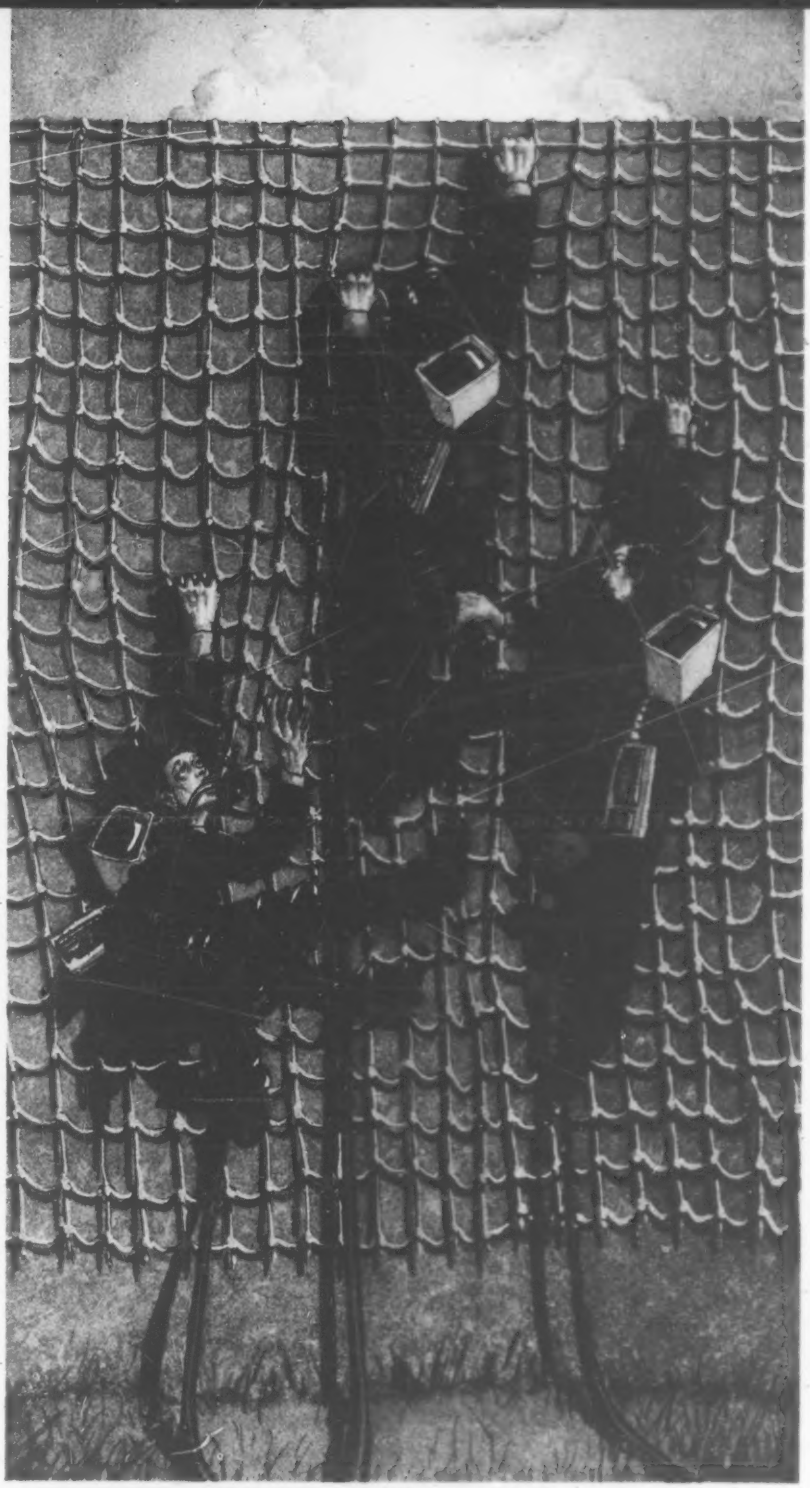
IBM's NetView has emerged as a de facto industry standard, primarily because of IBM's dominance in mainframes

Evolving networks

Network management isn't a new market, or even a new technology. Such functions and products have been essential components of corporate data processing since the beginning. But network management used to be far simpler, way back in the old days, when the all-powerful mainframe possessed all the processing power and intelligence. In those days, network management functions consisted largely of adding and deleting terminals, engaging and disengaging terminal cluster controllers, and other facilities that served the solitary host system.

In addition, every manufacturer offered its own network management system or services, usually proprietary in nature and capable of communicating only with the same type of equipment from the same manufacturer. "If you talk to any of these [vendors], they'll all say they have network management," says George Colony, president of Forrester. "The problem is that they don't work with each other's."

The era of multivendor computing environments, brought about by the proliferation of personal computers, word processors and other decentralized systems, brought with it the need for multivendor networking protocols and standards, such as the International Standards Organization's Open Systems Interconnect (ISO/OSI) Reference Model and the Manu-



facturing Automation Protocol/Technical Office Protocol (MAP/TOP). Not surprisingly, the need for multivendor network management systems and standards arrived shortly thereafter.

"Up until about four years ago, most network management systems were isolated, individual tools," explains John Mahr, senior product manager, Distributed Systems Management (DSM), at Tandem Computers Inc. in Cupertino, Calif. "Then there became an awareness that vendors needed to take a systematic approach to network management."

Technology and business forces also helped to highlight the need for more comprehensive network management systems. According to vendors and analysts, those forces include:

- Growth in the size of computer networks. Computer networks are growing much larger today, ranging into the tens of thousands of attached devices. In turn, managing, monitoring and detecting problems within those networks has grown much more complex.
- Networks have evolved from master/slave relationship frameworks, such as IBM's Systems Networking Architecture (SNA), to peer-to-peer links between distributed systems, such as minicomputers, departmental processors, workstations and above all, personal computers.
- A shortage of skilled personnel to man the network command center and manage the network.
- Increasing communication costs. Forrester forecasts that total communications expenditures in the crucial *Fortune* 1,000 marketplace will rise from $51 billion 1987 to $76 billion in 1991, a 50% increase.
- Computing and information systems have become strategic corporate resources. More companies depend on more computers and networks to keep their businesses running. Many companies, particularly in the fast-growing service sector industries, rely on their computers and networks to deliver revenue-producing goods and services to customers. The proliferation of bank automated teller machine networks, retail point of sale and other transaction processing system-based services attests to this.
- New technologies, such as T1 and Integrated Services Digital Network (ISDN), provide more data throughput across a single network line than previously available. While these increased network efficiencies will help hold down rising costs, they also serve to exacerbate the critical dependency of many companies on that network link.
- Finally, the breakup of the old Bell

Tom Barrett

System into AT&T and the regional Bell Operating Companies has opened up more long-distance and wide-area network connections.

The confluence of these forces has made network management a critical, strategic issue not just for vendors wanting to sell hardware, but for their customers as well. User frustration at the lack of network management tools from current suppliers might oblige them to run into the waiting arms of competitors.

"The need is so urgent that some of our customers can't wait," admits Tandem's Mahr. The first components of the company's DSM architecture, announced last fall, are already in selected customers' hands.

Vendors could feel the pinch in other ways as well. That frustration could have a ripple effect, Mahr and others warn, for if users can't grow their networks, they can't buy new systems. And because of the multivendor nature of networks, users are now demanding comprehensive network management systems that deliver a unified view of the network, and all the devices attached to it, from computers to modems and multiplexers and even applications residing on remote systems. "The first of those out the door was IBM's NetView," observes Tandem's Mahr.

HP's Bernard Gudion contends that vendors may not be able to sell systems if they don't offer superior network management systems

Dave Bradley

NetView has emerged as an undisputed de facto industry standard, primarily because of IBM's dominance of the mainframe world. NetView, which runs on IBM 370 and compatible mainframes, offers users a centralized, single point of view for IBM SNA networks. NetView/PC, a com-

The connectivity vendors: An overview

Four vendors are currently out in front as challengers to IBM's dominance of the network management marketplace. These firms hope to capitalize on IBM's weakness in the midrange systems marketplace, as well as on a growing user preference for open, industry-wide standards. These "connectivity vendors" include AT&T, Digital Equipment Corp., Hewlett-Packard Co., and Tandem Computers Inc. A brief overview of their respective network management offerings follows.

AT&T's UNMA

AT&T's offerings center on its Unified Network Management Architecture (UNMA), an umbrella architecture for a variety of network management products, services and open systems protocols that aim at providing integrated voice and data network management offerings. AT&T has pledged to base UNMA on the ISO/OSI reference model network management specifications, and to publish and license UNMA specifications to any interested parties.

UNMA is currently oriented toward managing the telephone line and customer premise equipment part of the networks, although AT&T's Bill Gilbert, division manager for network management planning at AT&T's Data Systems Division in Basking Ridge, N.J., claims that UNMA will eventually cover the spectrum of network management products and services.

"Our approach is intended to encompass a full range of network components, from end to end," Gilbert says. "It is not restricted to modems, multiplexers and lines." However, Gilbert adds that it is only natural that AT&T, a telecommunications giant, is "going to concentrate first on the management of those things we do best."

Tandem has published DSM specifications

Not surprisingly, UNMA has thus far gained the most support as an open industry standard from the ranks of datacommunications equipment suppliers, including DCA/Cohesive Inc., Dynatech Corp., General Datacomm Industries Inc., Integrated Telecom Corp., Newbridge Communications Corp. and Timeplex Inc.

HP's open view

HP's long-standing emphasis on standards carries over into its recently introduced Open View network management system. Open View, based on the ISO/OSI specifications, is designed to provide a comprehensive set of network management products and services to local area network and wide area environments outside the purview of IBM SNA networks.

The first release of Open View forms the foundation upon which the company will build future offerings. Currently, Open View offers systems management, performance management and a few other capabilities. Open View ties into IBM NetView through NetView/PC and uses HP Vectra PCs as network management workstations.

Perhaps its most distinguishing

plementary program that runs on IBM PCs, allows non-IBM SNA networks to participate in NetView network management functions by allowing reporting data into the IBM mainframe shop through a desktop IBM PC.

NetView/PC is as strategically important as NetView itself, because it solves the multivendor networking dilemma that has in large part created the current need for more advanced and sophisticated tools. Without NetView/PC or a similar product, IBM would have been justly accused of attempting to lock out non-IBM gear, a move widely viewed as unacceptable by most large corporate customers.

"IBM has held out an olive branch of multivendor networking to other vendors, and that is NetView/PC," says Forrester's Colony. And it's a branch most are grasping for. Even longtime network management specialists and IBM competitors such as Paradyne Corp., Largo, Fla., have come out with NetView and NetView/PC interfaces.

That, at least, is the image which IBM, a master of marketing spit and polish, projects for NetView. The reality is that although NetView addresses many customers' pressing needs for integrated network management tools, the product itself, at least in its earliest iterations, is little more than old IBM network management products, enhanced and repackaged.

By 1991, network management expenditures will reach $2.8 billion

Colony says that may account for IBM's claims of such a rapid convergence of the *Fortune* 1,000 on NetView as a standard. He says that Ellen Hancock, vice president and general manager of the IBM's Communications Systems Division, claims that 45% of the *Fortune* 1,000 companies have standardized on NetView. Colony believes that IBM counts users of Network Communications Control Facility and Network Problem Determination Authority products — the two old products upon which NetView is based — as "NetView users" as well.

Still, Colony says, "NetView is a raging success. It's a tidal wave that's going to take over network management."

The world against IBM

Others, while acknowledging IBM's importance and success with NetView, aren't quite so sure it's a tidal wave anywhere else but in the mainframe shop. "IBM is weakest in small- to medium-sized businesses that aren't dependent on an IBM mainframe," notes Clare Fleig, director of network management marketing at Hewlett-Packard Co., Palo Alto, Calif. "Our customers are looking for multivendor solutions."

HP's OpenView network management offering, announced in February, is a framework for integrating network management products from HP and other vendors. Its first application, LanProbe, is a software package that monitors and diagnoses problems on Ethernet LANs. Other applications, including a trouble-ticketing system, are planned.

OpenView's most distinctive feature, besides its ambitious positioning as an industry standard open to all, remains its graphically oriented, user interface based on the now-disputed Microsoft Corp. MS-Windows graphical interface and user operating environment. HP hopes that the interface as well as Open View offerings become part of the non-IBM world's network management standard.

Like AT&T, HP says it will publish and license Open View's specifications to all comers.

Tandem and DSM

Tandem's network management offerings are collectively dubbed Distributed Systems Management (DSM). DSM, also an umbrella, seeks to incorporate a full range of network management products and services — ranging from problem determination and error messaging — into the more sophisticated realms of remote systems management. A key feature of DSM is that, unlike NetView, it permits either centralized or decentralized network management functions, or a mix of both.

Currently, DSM manages only Tandem processors, although those processors can be connected through Tandem's proprietary Expand network, IBM SNA links, or X.25 public packet-switching networks. Tandem, not surprisingly, has positioned DSM as a "standard" for network management, and has published and released DSM specifications to others, particularly developers and suppliers of network equipment to Tandem network environments, so that they can conform their products to the DSM environment and protocols.

Digital remains the lone holdout

According to John Mahr, senior product manager of DSM, Tandem believes DSM will indeed become the standard for "mission critical" on-line transaction processing (OLTP) networks. Mission critical OLTP applications are those that deliver revenue-producing goods and services into the hands of customers, and include automated teller machines and retail point of sale networks, as well as factory automation and computer-integrated manufacturing application areas.

DEC and DECnet

DEC remains the lone holdout among the emerging ranks of connectivity vendors in not having an umbrella name and architecture for its DECnet network management. Nevertheless, DEC has extensive network management offerings for its widely installed DECnet products, offered as embedded DECnet products, layered products and custom services, according to David Kopf, DEC's manager for network management marketing.

DEC, he says, plans to leverage recently relabeled DECnet/OSI to signify its adherence to the ISO/OSI protocols and its status as open architecture with specifications available to others.

Analysts say the company has been briefing them, as well as customers, on a forthcoming network management offering similar to IBM's NetView and NetView/PC. A drawback, according to one analyst, is that DEC's NetView equivalent will be decentralized, as opposed to IBM's centralized version.

AT&T's William Gilbert: "OSI will provide a better and more comprehensive set of management tools for non-SNA resources"

tor of systems research at market analyst International Technology Group Inc., Los Altos, Calif. Other analysts go one step further, claiming IBM is not only weak, but vulnerable in that arena.

IBM's past sins keep coming back to haunt it, like bad dreams and old witches' curses. Despite its best efforts, IBM's midrange product line has been its most confused, scattered, and in the end, disappointing, line. That creates significant opportunities for vendors who lead the market in that area to penetrate what otherwise might be all Big Blue accounts.

George Weiss, program director for midrange systems at the Gartner Group Inc., in Stamford, Conn., says that a new class of three or four "connectivity vendors" is emerging from the ranks of the midrange systems manufacturers. These connectivity vendors, he says, will attempt to complement, rather than compete with IBM's NetView. They will also play a crucial role in connecting IBM's mainframe-based SNA networks with the rest of the corporation.

Most SNA networks don't extend their network management reach throughout the entire corporation. For instance, many companies have subnetworks of PCs in departments and factories that support other protocols. To bring these non-IBM SNA networks into the fold, IBM holds out NetView/PC. But competitors and critics charge that the NetView/PC doesn't measure up to what they can offer, or even to the standard NetView offering.

"IBM does a good job in managing IBM equipment in an SNA network," says HP's Gudion, "but not for non-IBM systems in a non-SNA network."

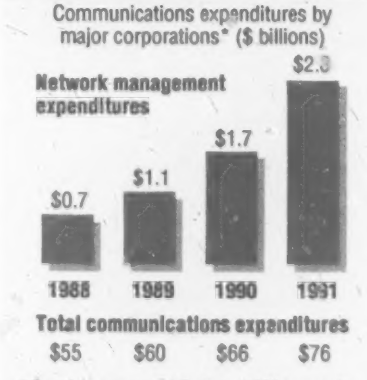
SNA has architectural limitations that NetView's competitors are bound to play on as well. "NetView may do well in [today's] SNA environment," notes DEC's Kopf, "but if you look out five years from now, to the confluence of voice, data and graphics across the same network, SNA just won't be able to handle that."

IBM's competitors are also playing the standards game. For the most part, those emerging connectivity vendors, whose ranks currently include AT&T, DEC, HP, and Tandem, are rallying around the network management components of the ISO/OSI Reference Model.

"OSI will provide a better and more comprehensive set of management tools for non-SNA resources," predicts William Gilbert, division manager, network management planning, for AT&T's Data Systems Division in Basking Ridge, N.J.

Still, there's one other factor that could play into the hands of IBM's network management competitors as well. If Big Blue doesn't deliver on time and as promised, "they could blow it," says Forrester's Colony.

Corporate spending for network management systems



Although small in comparison with total communications budgets, spending on network management systems will quadruple by 1991

A long way to go

All this leaves vendors with a long way to go in a short amount of time. Most expect the dust of a supercharged network management market to settle down to IBM and three to five important others over the next few years. Even then, it seems doubtful that customers will get that "single, unified" view from a comprehensive network management system they say they want.

"Over the next five years, our major customers will get their networks down to three, maybe four network management systems, with some degree of interaction between them," predicts Tandem's Mahr.

Anything beyond three or four interlocking network management systems might well have to wait for OSI network management protocols to solidify. Five years out should be just about the right time, some say. OSI will, by that time, form the basis for viable network management products, turning network management systems, like so much else, into a commodity-like product. Gartner's Weiss says that vendors will then have to try to outmaneuver each other by touting their particular value-added products such as languages, advanced computer-aided software engineering tools and user interfaces.

In the meantime, IBM's competition had best move quickly to hone their skills and deliver products in what may be prove to a crucial, make-or-break product offering area. From all reports, users will be taking sides and picking winners very soon.

Jeffrey Vock

CAE software: Still bundled after all these years

Analysts insist that CAE companies must get out of hardware reselling. Some vendors and customers like bundling too much to agree. Here's why

BY DAVID CARD

Listening to some industry observers, you might think CAE leader Mentor Graphics Corp. is in trouble. Funny how that doesn't seem to be the case. Mentor is coming off a record-setting year in sales — $221.8 million, and profits — $20.3 million, placing fifth on the ELECTRONIC BUSINESS list of fastest growing electronics companies. One of the key reasons why Mentor is twice the size of its nearest competitor is that it sells the computers which run its software.

Yet market researchers and Wall Street analysts have been saying for several years now that computer-aided engineering companies ought to get out of the hardware business. Time and again they bring up the example of the broader CAD/CAM industry where Computervision Corp. struggled for years to stop making its own computers. Similarly, in CAE, Mentor arch rival Daisy Systems Corp. — No. 15 on the fast-growth hit parade — is completing a difficult transition away from building its own workstations.

But all three still *sell* hardware with a vengeance; it's just that it's somebody else's hardware. Plus, some CAE software-only companies, including Case Technology and Teradyne Inc.'s CAE division, have recently added hardware to their catalogs. Two of the reasons are basic: CAE vendors say they can mark up profit on the hardware they resell, and many big CAE customers still want one-stop shopping.

That's not to say that long-term, the trend toward "unbundling" software from hardware won't continue. Andrew Rappaport, president of Boston consultancy The Technology Research Group, forecasts that by 1990, less than 40% of the workstations sold into CAE will be sold "turnkey," in bundled systems. That's down from 100% in 1983 and over 70% last year. He adds that CAE vendors slow to adapt will suffer from competitors who go software-only. "Mentor's biggest challenge is that the structure of the industry is changing out from under them," he says.

So if CAE players like Mentor are still pro-bundling, what keeps the unbundling trend rolling on? It's partly fueled by the CAE up-and-comers like Viewlogic Systems Inc. and ECAD Inc., which are strictly software-only and have focused on writing packages that can be ported onto different workstations.

Researcher Rappaport thinks Mentor needs to unbundle but doesn't want to. Take away the 40% of Mentor's sales that he estimates is hardware — Mentor has always resold workstations from Apollo Computer Inc. — and Mentor would "become a much smaller company in a hurry," he says. Plus, Rappaport concludes, Mentor would lose a lot of account control.

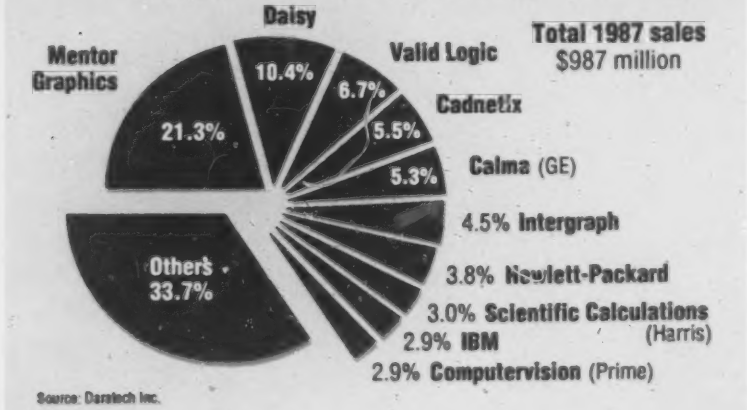
Maximum profits

Others put Mentor's hardware slice of revenue even higher: according to David Korus, a researcher with investment brokerage Kidder, Peabody & Co., it's as much as 55%. He doesn't like that. He and other Wall Street analysts want maximum profits when they demand for Mentor et al that "the Autodesk model is the model these companies have to follow." Autodesk Inc., the PC-based CAD leader, sells its drafting software through dealers. Korus can envision a day when CAE will go through dealers too — in imagining a "Chips R Us" store, he's only half-joking. By not selling hardware, and with a minimal salesforce, Autodesk keeps its gross margins above 80%.

Korus thinks CAE companies selling hardware are too hooked on the

Top U.S. electronics CAE/CAD suppliers

Share of 1987 worldwide sales by U.S. vendors



Source: Dataquest Inc.

idea of becoming *big* companies. "You don't want to give up 55% of your revenue," Korus says of Mentor management, "because you can't drive a Ferrari as easily."

Mentor president Gerard Langeler has a ready reply to that: he claims he needs a big top line to keep up his R&D spending. "Folks who go software-only tend to be niche players," he says. The Autodesk analogy is singularly inappropriate for CAE, Langeler says, because there are millions of potential drafting customers, compared with only 400,000 electrical engineers in the world. "Our applications are much more complex," he says, "and they need a lot more handholding." And anyway, Mentor's gross margins on systems are above 50% — "adequate, finally," for the demanding Langeler.

Mentor does offer software-only, but discourages customers by jacking up the price. As Apollo's largest OEM, Mentor commands nice discounts on Apollo workstations. Thus, looking at Mentor's price list, the computers seem very cheap — unbundled software commands a 20%-plus premium, Langeler says. He even picks up the profitable service business for the workstations.

Likewise, No. 2 CAE player Daisy still makes money off of computers, according to president Norman Friedmann. "A substantial part of the profitability is still in hardware," he says. "Bars sold drinks and gave away cigarettes. It ain't quite that way in this business." He adds: "I have not perceived a mad rush on the part of our customers to demand unbundling. We're prepared to do it [if necessary]."

Another company that, like Daisy, is making the switch from proprietary workstations, Cadnetix Corp., also continues to sell hardware. Cadnetix has moved onto a combination of PCs and Sun Microsystems Inc. workstations, yet reports 95% of its sales as turnkey, according to marketing vice president O.B. "Buck" Feltman. Cadnetix is a Wall Street favorite just as Mentor is, and has a similar attitude toward the stock peddlers.

Volume discounts

When the industry observers say that unbundling is the way to go, their theory is that big customers will cut volume discount arrangements with the workstation companies that will make the hardware cheaper for them than the CAE companies' discounts.

By that reasoning, Eastman Kodak Co. should be the archetypal Big Company CAE customer. Kodak was an original sponsor of Sun, is a Sun OEM, and even owns equity in the company. Yet Kodak buys the Sun workstations it uses for CAE from Case Technology, a CAE company that until recently was software-only.

Kodak senior project engineer Michael Cosgrove says he wants to be able to depreciate the CAE set-up as a system, instead of as hardware and software separately. The cost of overhead — including support and depreciation — is more important than the initial purchase cost, he says. Case charges a premium over the Sun list price.

Cosgrove admits that Kodak has software and maintenance deals with Digital Equipment Corp. that are tighter than the ones with Sun. And Case software runs on DEC hardware as well. But Cosgrove says he was willing to ignore the DEC ties — "DEC is bearing on us" about it, he says — because, he claims, the software simply runs better on Sun.

Westinghouse Electric Corp. qualifies as another such big customer, with over 50 CAE systems from Tektronix Inc., and half again as many from Mentor — all on Apollo workstations. (Mentor, partly to tie in customers like Westinghouse, recently bought out Tek's CAE business.) Yet Westinghouse also chooses to buy the computers from the CAE companies, according to John DeCaire, general manager of Westinghouse's Design and Producibility Engineering Division. Mentor "burns-in" the software on the hardware, which means "it works when it arrives," DeCaire says. Plus, buying systems from one source "avoids any finger-pointing about: What's the problem? and: Who's responsible?"

The fact that Kodak and also

Doreen Gay-Kassel

Xerox Corp. were willing to pay a premium for one-stop shopping is what convinced Case Technology to sell hardware, says president Kevin Kerns. "That's what answered my questions about turnkeying hardware," he says. He resells a maintenance contract, and Sun often ships the workstations directly to the end user so Case doesn't have to absorb the inventory costs. Kerns expects 25% of Case's sales this year to be bundled.

Other converts

Teradyne, Case's new parent, has a similar story, although both companies say their strategies developed independently. Less than 5% of Teradyne's CAE sales were bundled until now. Teradyne is best known as an automatic test equipment company, but it sells a CAE simulator that usually runs on DEC minicomputers. Now Teradyne is bundling DEC workstations with its simulator, a set-up that Teradyne CAE general manager Jeff Hotchkiss expects will meet 90% of his customers' requirements.

DEC is encouraging such arrangements for what it considers the low end of its product line, Hotchkiss says. Discounts for resellers are at par with those offered to volume end-users. That allows Teradyne to mark up hardware prices by 5% to 10%. Hotchkiss figures the bundled business will be pure gravy to Teradyne sales, so even the small margin goes straight to the bottom line. He adds another bonus: DEC competitors — many of which are Teradyne customers — don't mind buying a DEC hardware/Teradyne software combination as much as they might object to dealing directly with DEC.

"A substantial part of the profitability is still in hardware"
Norman Friedmann, Daisy

Even IBM, which has arguably the best third-party distribution channel going, sells CAE turnkey. IBM approaches things from the opposite direction compared with most CAE companies — it makes the hardware and resells somebody else's software. IBM's director of CAE marketing, Robert Tiel, finds Korus's "Chips R Us" concept "highly remote." He says: "We think dealers don't have what it takes. The guys we have selling simulation have master's degrees, and they're intimidated by the customers with Ph.D.s."

Although there are plenty of voices still in favor of bundling, analysts insist the underlying trend toward unbundling remains, for many other reasons. CAE buyers such as NASA, though they don't go to retailers, like to buy their hardware from computer companies. NASA's Langley Research Center bought CAE software from Case, but it bought the hardware on its own from DEC and PC clone makers.

One NASA engineer and CAE user, Randy Regan, explains that Langeley qualifies for DEC's government discount rate of 20% to 30%. Plus, it has many DEC computers already, and needed only additional software. But the kicker, Regan says, was that government purchases over $25,000 have to be advertised, adding another 30 days to the buying cycle. By separating the hardware and software purchasing, Reagan says, he can avoid the extra step and speed up the order. □

Creative software pricing 101

In the midst of the turnkey/unbundling debate, up pops another software issue to confuse CAE vendors. "People are starting to look at creative ways to price software," says Andrew Rappaport, president of The Technology Research Group. "There will be more demand to do what Valid is doing."

What Valid Logic Systems Inc. is doing seems almost a throwback to the days of the host computer. CAE companies in large part launched distributed computing with workstations, and have charged for software on a per-seat basis. One workstation, one set of CAE software; two workstations, two sets. But Valid's "Access" pricing scheme holds that customers don't have to pay for applications that aren't needed by every design engineer every minute.

Access is a network-brokerage licensing arrangement where a number of copies reside on a server, with "keys" at any given workstation. Engineers "check out" the software they need; if all the copies are out, they have to wait. Valid may make less selling fewer CAE packages, but it charges for the workstation keys — and hopes to "seed" a broader customer base.

Valid's strategy seems almost a throwback to the days of the host computer

Competitor Mentor Graphics Corp. is leery of Valid's strategy. "Network licensing at its extreme is site licensing," says Mentor president Gerard Langeler, "and there are ample indications that people who site-license don't stay in business." Customers who license software for a one-time corporate fee often don't come back for more, Langeler says.

Valid president W. Douglas Hajjar admits that it is too early to tell if his profits are going to suffer from his new pricing. But he disagrees that customers won't come back. Once engineers are addicted to his software, he says, "they're going to want the software without waiting in line. It's back to the old host problem." That's when Valid will sell more packages.

Tom Chai, CAD and ASIC general manager for Wyse Technology, says using Valid's new program saved as much as 50% on software costs. Chai is "trying to push it to other vendors," he says. Mentor customer Westinghouse Electric has heard of Valid's system, and appears appreciative. "We're looking forward to being able to do that," says a Westinghouse general manager, John DeCaire. □

CAD/CAM after Computervision: Will anything really change?

As Prime Computer figures out how to manage its CV acquisition, rivals see opportunity. There could be strategic shifts for hardware suppliers, too

BY DAVID CARD

The hostile takeover is done, but, as usual, the real battle is just beginning. Prime Computer Inc.'s $435 million acquisition of Computervision Corp. in January means there is a new No. 2 in computer-aided design and manufacturing.

On its own, Prime held just 3.6% of the $4.6 billion CAD/CAM equipment market last year. But this year, it will boast a 16% slice of a market that will be worth $5.2 billion, forecasts Daratech Inc. The Cambridge, Massachusetts-based researcher expects the market to grow at about 10% annually through the 1990s.

But Prime's second-place crown is a paper one unless Prime can hold off competitors that see a chance to pick off contracts. "It's not like we're sharks circling the bait," says Michael Smith, a marketing director at competitor Schlumberger/Applicon. "But it *is* a competitive market."

Prime's new CAD/CAM stance will also color already complex relationships with hardware suppliers, such as those with Digital Equipment Corp. and Sun Microsystems Inc.

Newly displaced Intergraph Corp. is watching the old fear, uncertainty and doubt factor. "There's a lot of FUD right now that we could take advantage of," says Intergraph vice president Robert Glasier.

However, Marvin Kirby, Prime's vice president for CAD/CAM marketing, which includes Computervision, isn't worried. Kirby sees "no negative effects in terms of business" since the merger. Orders for both product lines "are about as forecast," Kirby says. And he remains noncommittal about how long it will take to get things working smoothly. "Over time, where it makes sense," Kirby says, "we will tie the [Prime and CV] functions together. We will not force anyone to do it where they don't want to."

But does this mean meshing of product lines? Natick, Massachusetts-based Prime is, of course, a minicomputer maker, although it is flexible in its CAD/CAM business. Prime resells Sun workstations as midrange machines, and Silicon Graphics Inc. high-end workstations, along with its minis. According to David Burdick, an analyst at San Jose market researcher Dataquest Inc., Prime claims there is "a synergy in the product lines" between it and its Bedford, Mass., neighbor Computervision. "We don't buy that," Burdick says.

But the Dataquest researcher sees the merger as a good way to gain share in a maturing market. If it does work out, he maintains that it's a major threat to the "larger turnkey companies that offer end-to-end solutions," like IBM and Intergraph. Daratech president Charles Foundyller agrees, but adds that the PC CAD leader, Autodesk Inc., might feel the heat from the combo: "For the first time somebody has a shot at at least slowing Autodesk down."

Dave Bradley

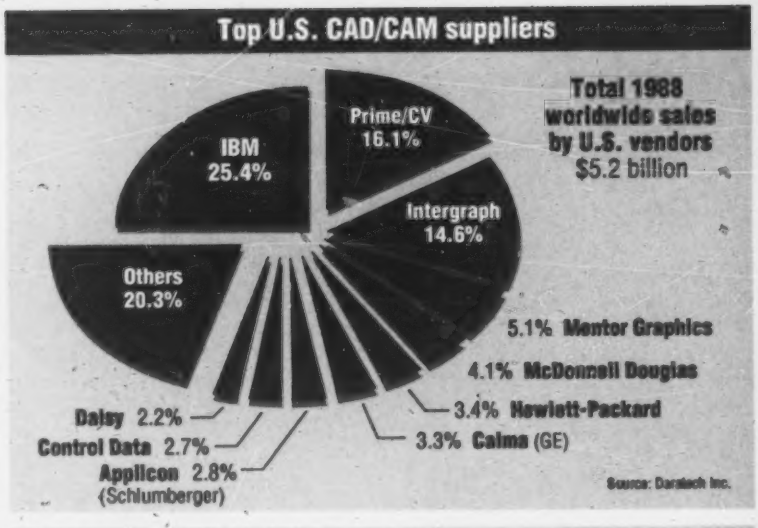
Prime's CAD/CAM chief, Marvin Kirby, says customers are willing to give Prime the time it needs

Emphasis on execution

Daratech's Foundyller likes Prime's long-term prospects a lot better than premerger Computervision's. "Prime has a long-term play," he says, "now it's execution. There are still many ways to screw up."

Prime bought another CAD company last year, VersaCAD Corp., that sells software for personal computers. Prime is "integrating VersaCAD with a surgeon's hand," says VersaCAD president Tom Lazear. "Often mergers are done with meat hooks and clubs and something gets ruined."

Not surprisingly, competitors are



Prime's acquisition plus its own fast growth equals No. 2 in CAD/CAM

less bullish on the link-up. No. 4 in CAD/CAM — and No. 1 in the market's electronics segment — is Mentor Graphics Corp. Mentor president Gerard Langeler says the immediate effect of the acquisition has been to "put a lot of good resumes on the street." A handful of top CV executives, including president Robert Gable, has left.

"In the history of the CAD/CAM business, there has never, ever been a merger that worked well," charges Mentor's Langeler. "CV wasn't nearly as healthy as Calma and Applicon when they were purchased." Applicon has indeed lost market share fairly steadily since its acquisition by Schlumberger Ltd., as has Calma since General Electric Co. stepped in, according to Daratech.

CV helped invent CAD/CAM, and used to own the market. As late as 1984, CV was still No. 1, but its market share had halved from 30% in the late '70s. It wasn't so much CV shrinking as IBM and Intergraph growing, although the company had tough times recently, losing a total of nearly $90 million in 1985 and 1986. Foundyller and others attribute much of CV's decline to its reliance on homemade minicomputers, as the industry shifted to computers from workstation companies, IBM and DEC. But CV had turned its balance sheet positive, and switched to workstations from Sun [ELECTRONIC BUSINESS April 1, 1987 p51] when Prime made its offer.

Meanwhile, Prime's big turnkey rivals are not waiting around. Dassault Systems USA is the U.S. marketing arm of the French aerospace company that makes CAD/CAM software which IBM resells. Dassault Systems USA president Joan Hoeberichts has her eye on the CV customer base: "We're certainly courting them. The confusion in the organization is not working in their favor in the marketplace." She's looking at Prime customers, too: "The only place Prime is a real force at all is at Ford. We've already been there."

At Ford, integration is Job 1

Well, if Dassault/IBM is calling on Ford Motor Co., Ford has not been listening too hard. Bill Powers, director of production and manufacturing systems for Ford's North American Automotive operations, says he has not seen the "hard sell" from other CAD/CAM companies since the merger, but he admits that may be because Ford is the most loyal of Prime and CV customers. He claims Ford is Prime's largest CAD/CAM customer and CV's largest non-government user.

As probably the only customer with a large CV *and* Prime base, Ford was particularly undisturbed by the merger. Says Powers: "Basically, we have always had good communications with both companies. Now that they are together, it even helps with some of our internal problems." Especially in integrating the two: for instance, making the automotive power train systems that are designed on CV equipment fit into the body work done on Prime CAD. (Actually, the Prime CAD system that Ford uses is not off the shelf; it was codeveloped by Prime and Ford.)

One twist to the Prime/CV deal is the relationship with DEC. Besides its sourcing from Sun, Computervision sells a little DEC hardware, mostly in Europe. Applicon's Smith sees openings there and in the United States for Applicon, which sells DEC computers and workstations as well as Sun's. Computervision was a DEC strategic cooperative marketing partner (SCMP), but Smith doesn't think that will last: "I would think they would withdraw."

Prime's Kirby has a quick answer for that: "The relationship with DEC has not changed. Other people are saying: 'Hey, they're going to make you go with a Prime platform.' " That's not true, he says. But he does admit the SCMP status is a little uncertain. "We're proceeding to try and hammer that one out," he says.

If the DEC ties are being strained, the Sun connections are firming. Prime CAD/CAM president Robert Fischer told ELECTRONIC BUSINESS last year that the margins he would make reselling Sun workstations were pretty thin. But CV was one of Sun's first OEMs, and was thus able to cut a manufacturing arrangement with the young company. The "technology, manufacturing, and OEM agreements [with Sun] apply across the entire corporation," Kirby explains. That is, Prime can now buy board-level computers from Sun under the CV deal, adding meat to its margins. Would Prime consider moving Sun workstations aggressively into its other computer markets? "As we see the opportunity to do it, you could expect us to do it," concedes Kirby.

The acquisition should unite some software as well. CV owns Cambridge Interactive Systems Ltd., the British company that wrote the original "Medusa" mechanical CAD software that both CV and Prime sell. CV sold more Medusa in Europe than in the United States, according to Kirby, so the overlap is complementary rather than competitive.

But in April Prime brought out a new version of Medusa-compatible software for its Silicon Graphics workstations. "That surprises me," says Dataquest's Burdick. "That just adds another bit of confusion — whether it's going to be a trench battle between the two companies over who has the best CAD/CAM product." □

Back to basics for growth: RISC microprocessors

RISC is to computers what the stick shift is to hot rodders. It also may make money for chip makers

Hot rodders waiting for a red light to turn green know very well that, engine sizes being equal, a skillful hand at a stick shift can outperform even the best automatic transmission. Their skill is needed to translate their objective — to accelerate from zero to cruising speed in minimum time — into steps that their clutch, gearbox and engine can take without buckling under the strain. By contrast, the more complex automatic transmission will pick up speed in the correct sequence every time, regardless of the driver's skill, but at the expense of acceleration, acquisition cost and fuel efficiency.

Same with microprocessors. Looking to run more mega-instructions per second (MIPS) in their computers, hot bit logic designers today are turning to microprocessors based on reduced instruction set computing architecture. Like manual transmissions, RISC microprocessors carry fewer, more elementary instructions than the currently popular CISC, or complex instruction set computing micros. Like automatic transmissions, CISC's elaborate instructions make it easier to specify functions (such as direct memory access), but do so at MIPS' expense because they require an internal microprogram to decode the complex instructions into elementary logic.

Add to that the increasing size and density of modern chips, and you see why RISC has put a MIPS gleam in chip makers' eyes. From comparisons with Digital Equipment Corp.'s VAX less than two years ago, their talk has climbed now into the MIPS range of Cray Research Inc.'s supercomputers.

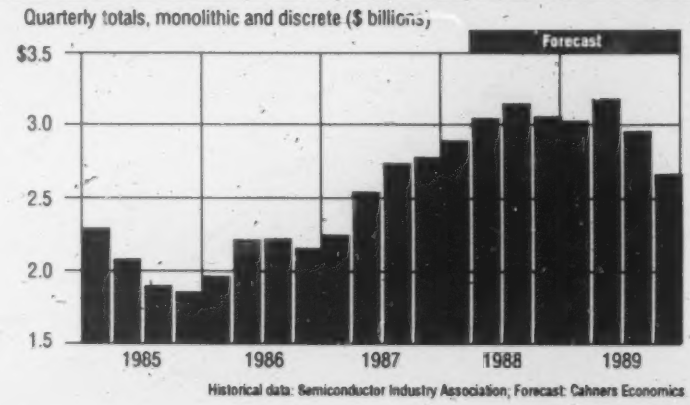
Jack Beedle sees RISC as the next growth market for semiconductors. The president of market researcher In-Stat Inc. counts only five chip makers who are making RISC microprocessors today: Intel Corp., Intergraph Corp., MIPS Computer Systems Inc., Motorola Inc. and Sun Microsystems Inc.

High-power microprocessors look like the next fertile ground where the seeds for new companies are being sown. Worldwide sales of their CMOS versions, used primarily for the faster and more complex models, more than tripled (in dollars) in the first quarter of 1988, with respect to the same quarter of last year. Unit growth contributed only one-third of the increase. The rest of that increase resulted from a doubling in prices, up from an average of $10 to $20 per unit. While there are shortages of Intel's highly popular 32-bit 80386, most of the price climb derives from a change in mix from 16- to 32-bit processors.

Such is not the case in memories. "The market [for 256K DRAMs] has almost $1 billion that can evaporate when prices come down," says Daniel Queyssac, president and CEO of SGS-Thomson Microelectronics Inc. This may happen by the end of 1988, when most observers predict that worldwide production of memory chips will catch up with the demand. Still, by then the U.S. market for ICs will have grown by 24% over 1987, to more than $10 billion, forecasts Cahners senior economist Elizabeth Baatz. She foresees another 20% growth in 1989. So, even if the billion-dollar memories do evaporate, there will be plenty of dollars worth of microprocessors, both conventional CISC and MIPS-powerful RISC, to take up that slack.

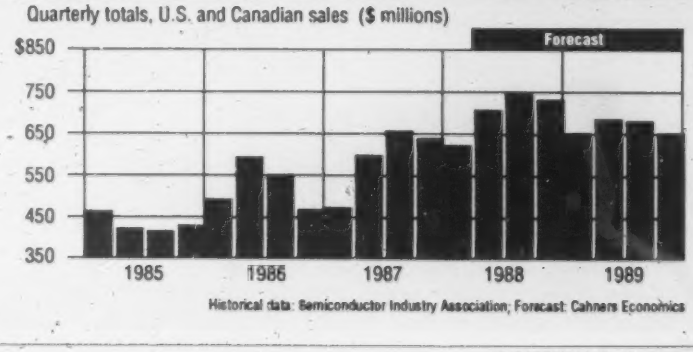
ALBERTO SOCOLOVSKY

U.S. semiconductor sales



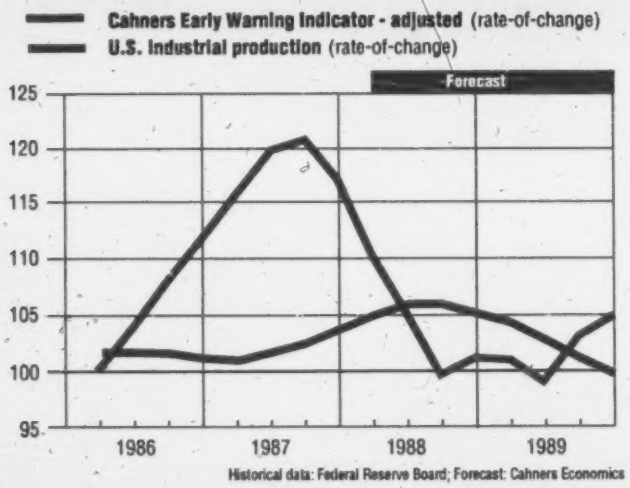
Historical data: Semiconductor Industry Association; Forecast: Cahners Economics

U.S. semiconductor distributor sales



Historical data: Semiconductor Industry Association; Forecast: Cahners Economics

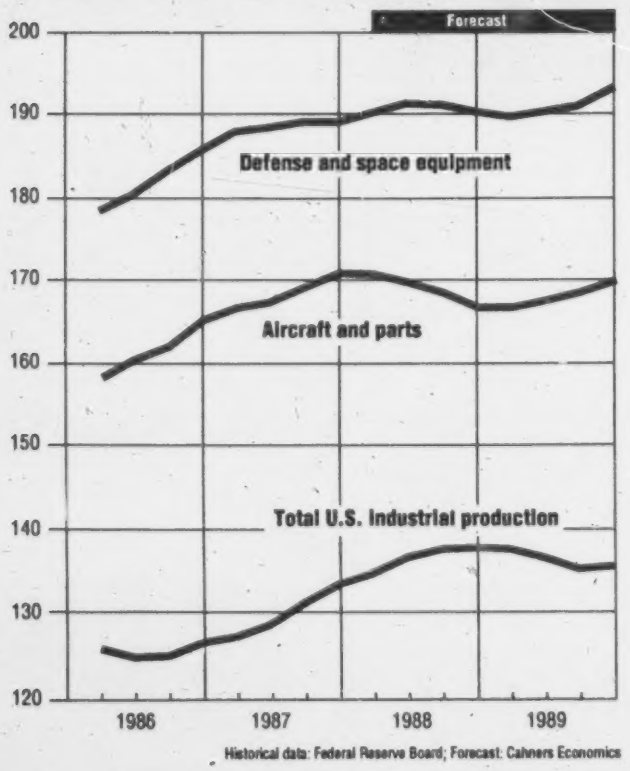
U.S. economic indicators



Historical data: Federal Reserve Board; Forecast: Cahners Economics

Defense equipment — Industrial production

Quarterly averages, 1977 = 100, seasonally adjusted



Historical data: Federal Reserve Board; Forecast: Cahners Economics

U.S. exports and business investment fuel growth

The indicator peaked in the third quarter of 1987 and is heading for a low point in the second quarter of 1989. But the downturn will be mild and short-lived, according to the CEWI readings. The growth expected in U.S. industrial production has been revised downward slightly for 1988 by Cahners Economics. So, instead of slowly accelerating growth this year, industrial output will hover around the 5.1% to 5.9% range all year, before heading down in 1989. The reason for the revision? Inventories of imported goods are high. This could result in greater import price competition and U.S. manufacturers could feel the heat. Still, export growth and renewed business investment will steer U.S. industry to steady growth gains this year, albeit somewhat lower than Cahners' predictions several months ago.

More information can be obtained from Elizabeth Baatz, economist, Cahners Economics Department, 275 Washington St., Newton, Mass. 02158.

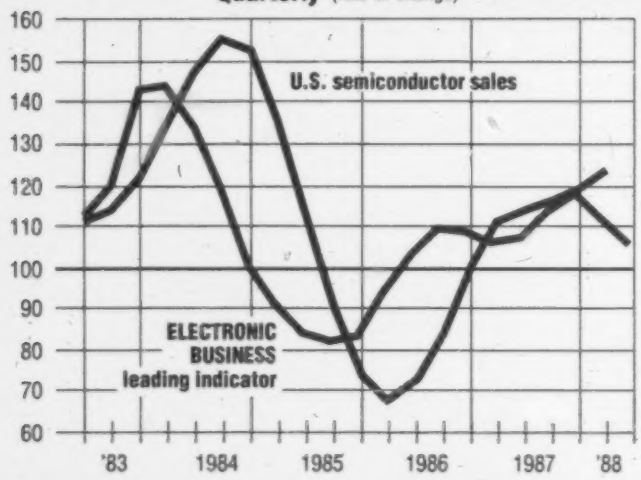
Defense and aircraft production holding

Factory production in the United States for defense and space equipment rose 0.5% in the first quarter of 1988 and is headed for a 1% annual gain this year. The Congressional Budget Office projects average growth of national defense outlays of only 2.8% over the next three years. While the Department of Defense budget actually will be falling in inflation-adjusted dollars, the Electronic Industries Association projects spending on the electronic content to increase to around 40% this year, up from 37% in 1986. The focus now is on modernization and cost effectiveness. Companies involved with space electronics, training and simulation, command, control, communications and intelligence (C^3I) will weather the constricting defense budget the best.

The aircraft industry faltered in early 1988 as production fell 0.3% in the first quarter of this year. Cahners Economics forecast that U.S. factory output of aircraft will be neither growing nor falling significantly over the next two years. Production of a number of military initiatives, such as the B-1B bomber and C-5B cargo plane, are winding down. Although some aircraft procurement programs will be stretched out, development of several others may be delayed or dropped altogether.

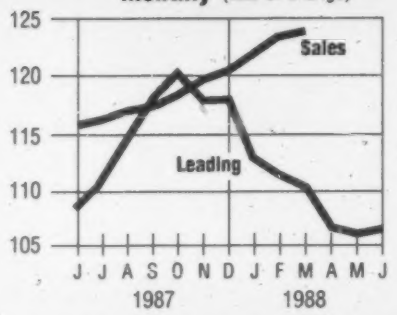
ELECTRONIC BUSINESS leading indicator

Quarterly (rate-of-change)



The ELECTRONIC BUSINESS leading indicator predicts turning points in U.S. semiconductor sales with about a three- to nine-month leadtime. For more information please contact Elizabeth Baatz, senior economist, Cahners Publishing Co., 275 Washington St., Newton Mass. 02158 or call (617) 558-4368

Monthly (rate-of-change)



The ELECTRONIC BUSINESS indicator fell to 111.5 in February from 112.9 in January. This was the fourth consecutive monthly decline. The indicator is estimated to fall to the 106-107 level in June, back to its early 1987 level. What does it mean? U.S. semiconductor sales will likely peak this summer, but the downturn this fall will be relatively mild.

Source: Cahners Economics

Electronic industry indicators this month

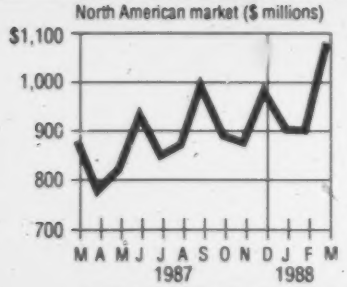
	Latest month	Previous month	Year ago	1987 average
ELECTRONIC BUSINESS leading indicator (rate-of-change, Feb.)	111.5	112.9	105.6	111.8
U.S. semiconductor bookings ($ millions, 3-month average, March)	$1,126	$1,080	$912	$951
Weekly hours of semiconductor production workers (monthly average, Feb.)	40.1	40.4	40.6	40.6
Electronic components leadtime index (1977 = 100, April)	105.2	106.8	105.7	100.7
Standard & Poor's semiconductor price index (1970 =10, monthly average, March)	59.2	52.9	63.6	65.5
Change in electronic components inventories ($ millions, SA, March)	+$52	+$142	-$36	+$46
Contract and orders for plant and equipment ($ billions, SA, March)	$37.8	$38.8	$32.8	$34.4

SA = seasonally adjusted; all other data is not seasonally adjusted

Sources: Semiconductor Industry Association, U.S. Bureau of Labor Statistics, *Electronics Purchasing* magazine, Standard & Poor's, U.S. Commerce Department, U.S. Bureau of Economic Analysis

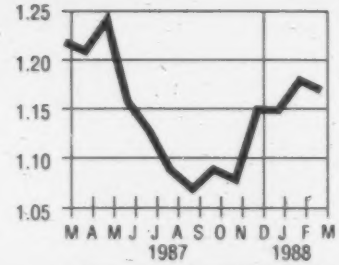
Semiconductor sales

North American market ($ millions)



Source: Semiconductor Industry Association

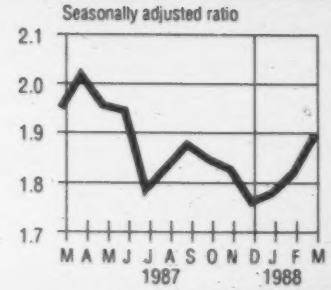
Semiconductor book-to-bill ratio



Source: Semiconductor Industry Association

Component inventory-to-shipments

Seasonally adjusted ratio



Source: U.S. Commerce Department